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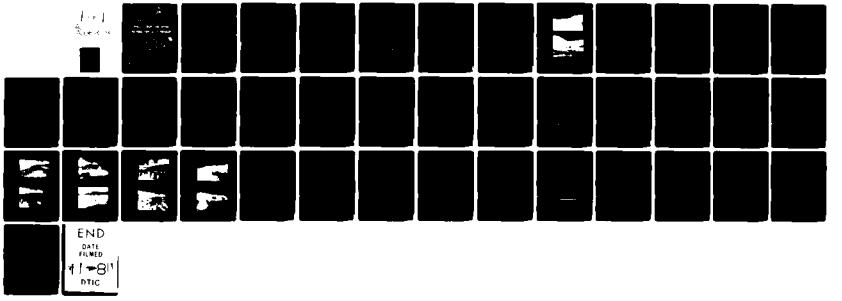

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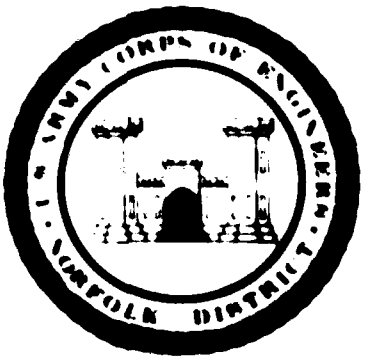
JAMES RIVER BASIN

AD A106328

LEVEL II

Name Of Dam: TURNER
Location: ROCKBRIDGE COUNTY
Inventory Number: VA 16308

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM



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803 FRONT STREET
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JULY 1981

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SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE	READ INSTRUCTIONS BEFORE COMPLETING FORM
1 REPORT NUMBER: VA 16308	2 GOVT ACCESSION NO: AD A106 324	3 RECIPIENT'S CATALOG NUMBER:
4 TITLE (and Subtitle): Phase I Inspection Report National Dam Safety Program Turner Rockbridge County, VA	5 TYPE OF REPORT & PERIOD COVERED: Final 6 PERFORMING ORG REPORT NUMBER:
7 AUTHOR(s): Norfolk District, Boris O. Taran	8 CONTRACT OR GRANT NUMBER(s):
9 PERFORMING ORGANIZATION NAME AND ADDRESS: U. S. Army Engineer District, Norfolk 803 Front St., Norfolk, VA 23510	10 PROGRAM ELEMENT PROJECT TASK AREA & WORK UNIT NUMBERS:
11 CONTROLLING OFFICE NAME AND ADDRESS: U. S. Army Engineer District, Norfolk 803 Front St., Norfolk, VA 23510	12 REPORT DATE: July 1981 13 NUMBER OF PAGES:
14 MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office):	15 SECURITY CLASS (of this report): Unclassified 15a DECLASSIFICATION DOWNGRADING SCHEDULE:

16 DISTRIBUTION STATEMENT (of this Report)

Approved for public release; distribution unlimited

17 DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18 SUPPLEMENTARY NOTES

Copies are obtainable from National Technical Information Service, Springfield, Virginia 22151

19 KEY WORDS (Continue on reverse side if necessary and identify by block number)

Dams - VA
National Dam Safety Program Phase I
Dam Safety
Dam Inspection

20 ABSTRACT (Continue on reverse side if necessary and identify by block number)

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20. Abstract

Pursuant to Public Law 92-367, Phase I Inspection Reports are prepared under guidance contained in the recommended guidelines for safety inspection of dams, published by the Office of Chief of Engineers, Washington, D. C. 20314. The purpose of a Phase I Inspection is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general conditions of the dam is based upon available data and visual inspection. Detailed investigation and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

Based upon the field conditions at the time of the field inspection and all available engineering data, the Phase I report addresses the hydraulic, hydrologic, geologic, geotechnic, and structural aspects of the dam. The engineering techniques employed give a reasonably accurate assessment of the conditions of the dam. It should be realized that certain engineering aspects cannot be fully analyzed during a Phase I inspection. Assessment and remedial measures in the report include the requirements of additional indepth study when necessary.

Phase I reports include project information of the dam appurtenances, all existing engineering data, operational procedures, hydraulic/hydrologic data of the watershed, dam stability, visual inspection report and an assessment including required remedial measures.

JAMES RIVER BASIN

NAME OF DAM: TURNER
LOCATION: ROCKBRIDGE COUNTY, VIRGINIA
INVENTORY NUMBER: VA 16308

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

National Dam Safety Program. Turner Dam (Inventory Number VA 16308), James River Basin, Rockbridge County, Virginia. Phase I Inspection Report.

PREPARED BY
NORFOLK DISTRICT CORPS OF ENGINEERS
803 FRONT STREET
NORFOLK, VIRGINIA 23510

JULY 1981

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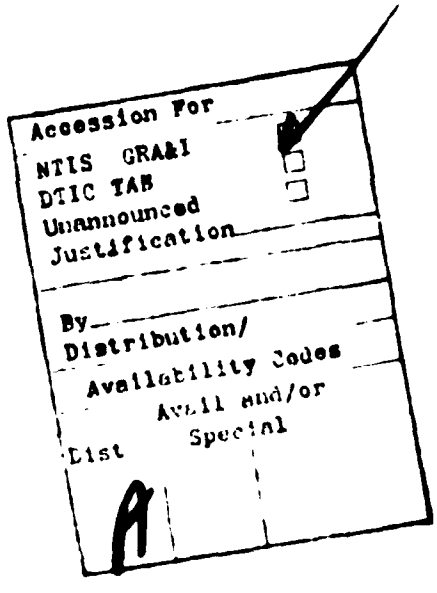


PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of the Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation and analyses involving topographic mapping, subsurface investigations testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that unsafe conditions be detected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established guidelines, the spillway design flood is based on the estimated "Probable Maximum Flood" for the region (flood discharges that may be expected from the most severe combination of critical meteorologic and hydrologic conditions that are reasonably possible), or fractions thereof. Because of the magnitude and rarity of such a storm event, a finding that a spillway will not pass the design flood should not be interpreted as necessarily posing a highly inadequate condition. The design flood provides a measure of relative spillway capacity and serves as an aide in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

PHASE I REPORT
NATIONAL DAM SAFETY PROGRAM

BRIEF ASSESSMENT OF DAM

Name of Dam:	Turner Dam
State:	Virginia
Location:	Rockbridge County
USGS Quad Sheet:	Natural Bridge, Virginia
Stream:	Tributary of Cedar Creek
Date of Inspection:	7 July 1981

Turner Dam is an earthfill structure about 800 feet long and 45.2 feet high. The dam is owned and maintained by Natural Bridge of Virginia, a private firm. The dam is classified as an intermediate size dam with a significant hazard classification. The designed principal spillway is a 10-inch steel drop-inlet stand pipe located in the reservoir. Because of underlying cavernous limestone beneath the reservoir, the water level is considerably below the normal design pool. There are two emergency spillways. The left emergency spillway is an open channel spillway which is a low point in natural ground. The right emergency spillway is an open channel cut into natural ground. The reservoir was designed for recreation but also serves as flood control for the community of Natural Bridge.

Based on criteria established by the Department of the Army, Office of the Chief of Engineers (OCE), the Spillway Design Flood (SDF) is the 1/2 PMF. The spillways will pass the PMF without overtopping; therefore, the spillways are adjudged as adequate.

The visual inspection revealed no apparent problems or remedial measures in need of immediate attention. A stability check is not required. There is no formal regular maintenance operation program or warning system, and it is recommended that a formal maintenance program and warning system be established. The maintenance items listed in Section 7.2 should be accomplished as a part of the regular maintenance program within the next 12 months.

Submitted By:

Original signed by:
Carl S. Anderson, Jr.

CARL S. ANDERSON, JR., P.E.
Acting Chief, Design Branch

Recommended By

Original signed by
JACK G. STARR

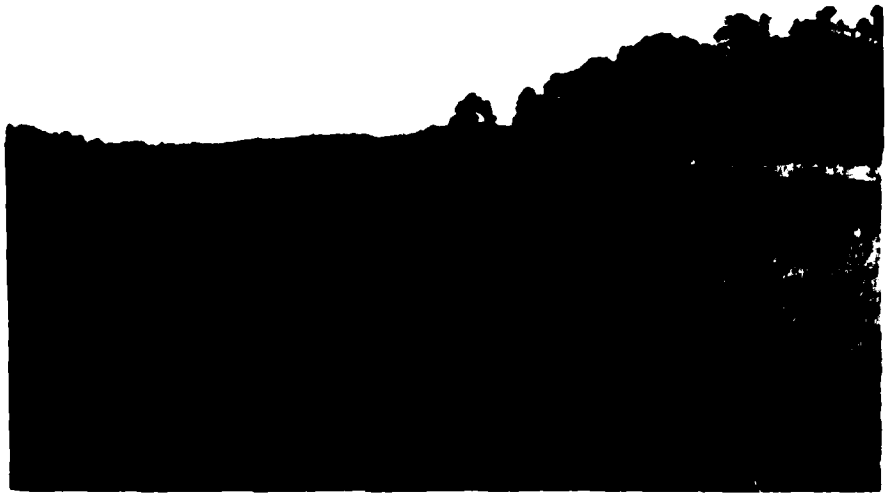
JACK G. STARR, P. E.
Chief, Engineering Division

Approved:

Original Signed by:
Michael M. Jenks

RONALD E. HUDSON
Colonel Corps of Engineers
Commander and District Engineer

Date: SEP 18 1981



DAM

RESERVOIR AREA

OVERALL VIEW - TURNER DAM
ROCKBRIDGE COUNTY

7 JULY 1981

SECTION 1

PROJECT INFORMATION

1.1 General:

1.1.1 Authority: Public Law 92-367, 8 August 1972, authorized the Secretary of the Army, through the Corps of Engineers to initiate a National Program of Safety Inspections of Dams throughout the United States. The Norfolk District has been assigned the responsibility of supervising the inspection of dams in the Commonwealth of Virginia.

1.1.2 Purpose of Inspection: The purpose is to conduct a Phase I inspection according to the Recommended Guidelines for Safety Inspection of Dams (Reference 1, Appendix IV). The main responsibility is to expeditiously identify those dams which may be a potential hazard to human life or property.

1.2 Project Description:

1.2.1 Dam and Appurtenances: Turner Dam is an earthfill structure approximately 800 feet long and 45.2 feet high. The crest of the dam is 22 feet wide with an average crest elevation of 1258.0 feet msl. The upstream slope is 1.0 vertical to 2.6 horizontal (1V:2.6H). The downstream slope is 1V:3H. There is no slope protection.

According to Mr. Barger, a local resident, the foundation was keyed into the residual soil. There is no known foundation drainage system. There are no visible foundation drain outlets.

The designed principal spillway is a 10-inch steel drop-inlet stand pipe located in the reservoir. The stand pipe is connected to another 10-inch steel pipe passing through the dam at low level and discharges at the downstream toe. A plug has been placed into the outlet pipe to prevent leakage through the dam.

The left emergency spillway is an open channel spillway which is a low point in natural ground. The approximate width is 100 feet with a minimum elevation of 1255.0. Flows through this spillway will pass into the downstream channel at the toe of the dam.

The right emergency spillway is an open channel cut into natural ground. The approximate width is 40 feet with a minimum elevation of 1252.3. Flows through this spillway will pass down hill and enter the downstream channel after the channel parallels U. S. Route 11.

The reservoir can be dewatered by rotating the 10-inch stand pipe from a vertical to horizontal position and unplugging the outlet pipe below the dam.

1.2.2 Location: Turner Dam is located on a tributary of Cedar Creek less than one mile north of Natural Bridge, Virginia.

1.2.3 Size Classification: The dam is classified as an intermediate size dam as defined in Reference 1 of Appendix IV.

1.2.4 Hazard Classification: The dam is located less than one mile north of Natural Bridge, Virginia. Several homes located on U. S. Route 11 and several businesses around the parking lot to the Natural Bridge Visitation Center could sustain property damages due to a dam failure. Therefore, a significant hazard classification is given for this structure according to guidelines contained in Section 2.1.2 of Reference 1, Appendix IV. The hazard classification used to categorize dams is a function of location only and has nothing to do with their stability or probability of failure.

1.2.5 Ownership: Natural Bridge of Virginia

1.2.6 Purpose: The dam was built for recreation but now serves as limited flood control.

1.2.7 Design and Construction History: The designer of Turner Dam is unknown; although the Soil Conservation Service did offer some assistance in design. Echols Brothers built the dam in 1947. The outlet pipe through the dam was plugged around 1975 to prevent leakage through the dam. The reservoir level during normal operations never reaches the designed normal pool level due to seepage into the underlying cavernous limestone at about elevation 1234.65.

1.2.8 Normal Operational Procedures: Water passes automatically into the underlying cavernous limestone when the reservoir rises to elevation 1234.65. The principal spillway will not function with the plug placed into the outlet. If the reservoir rises to elevation 1252.3, water will pass over the left emergency spillway. As the pool continues to rise it will pass through the right emergency spillway at elevation 1255.

1.3 Pertinent Data:

1.3.1 Drainage Area: The dam controls a drainage area of 0.32 square miles.

1.3.2 Discharge at Dam Site: The maximum reservoir pool has not reached the left emergency spillway, elevation 1252.3.

Pool level at crest of dam

Left Emergency Spillway.....582 cfs
Right Emergency Spillway.....3810 cfs

1.3.3 Dam and Reservoir Data: Pertinent data on the dam and reservoir are shown in the following table:

TABLE 1.1 DAM AND RESERVOIR DATA

Item	Elevation feet msl	Reservoir			
		Area Acres	Capacity Acre feet	Watershed, Inches	Length, feet
Crest of Dam	1258.0	22.5	355	20.8	1150
Left Emergency Spillway Crest	1255.0	21.9	291	17.1	1100
Right Emergency Spillway Crest	1252.3	21.3	240	14.1	1050
* Normal Pool	1234.65	1.8	4.3	0.3	550
Streambed at Downstream toe of dam	1212.8	-	-	-	-

* Elevation is controlled by seepage lost into underlying cavernous limestone.

SECTION 2

ENGINEERING DATA

2.1 Design: There is no known design information, except that the Soil Conservation Service did offer some assistance in design.

2.2 Construction: The dam was constructed by Echols Brother Construction Company. The dam was completed in 1947. According to Mr. Barger, the foundation was keyed into the residual soil. The embankment material was borrowed from an area along the left side of the reservoir. There are no known construction records.

2.3 Evaluation: There is insufficient information to evaluate the foundation condition and the embankment stability.

SECTION 3

VISUAL INSPECTION

3.1 Findings:

3.1.1. General: The results of the 7 July 1981 inspection are recorded in Appendix III. At the time of the inspection, the weather was sunny and the temperature was about 90° F. The reservoir elevation was 1234.65 feet msl. The inspection team was unable to determine the elevation of design normal pool, but it appeared to be about 12 feet above the existing pool or about 1248 feet msl. The tailwater elevation was not measured since the downstream channel was dry, however, the downstream channel elevation at the toe of the dam was about 1212.8 ft msl. There are no known past inspection reports available.

3.1.2 Embankment: The general soil condition was moist. There are no signs of surface cracks, unusual movement, or misalignment. There is surface erosion on the upstream slope probably due to pedestrian and cattle traffic and aggravated by surface runoff. There is no riprap on the upstream face. The embankment material is a residual, red high plastic clay borrowed from an area adjacent to the left side of the reservoir. The downstream slope has a good covering of grass. The crest serves as a gravel access road. There are no known drains. There is one tree about 12 inches in diameter on the upstream slope near the right abutment.

3.1.3 Principal Spillway: A 10-inch steel pipe serves as the principal spillway drop inlet riser. The outlet pipe is a low level outlet pipe which passes through the embankment and discharges near the downstream toe. The outlet is plugged to prevent leakage. The principal spillway standpipe can be rotated from a vertical to horizontal position and the plug removed from the outlet pipe to dewater the reservoir.

3.1.4 Emergency Spillway: LEFT - The emergency spillway is located in natural ground at the left abutment. A gravel access road traverses the control section. The approach channel has a good grass cover. The discharge channel is down the left abutment contact and has a good grass cover.

RIGHT- The control section was cut into natural ground and has a good grass cover. The gravel access road traverses the control section. The approach channel has a good grass cover. The discharge channel is down the right abutment and has a good grass cover.

3.1.5 Instrumentation: There is no instrumentation on the dam.

3.1.6 Reservoir Area: The right reservoir slopes are moderately steep with the left reservoir slopes having a gentle rise. The

immediate reservoir area is grassed, and the rest of the drainage area is heavily wooded. No debris was observed in the reservoir. There is no available information pertaining to sedimentation.

The reservoir is maintained at about 12 feet below design normal pool by seepage into the underlying cavernous limestone, except during periods of above normal rainfall. One opening in the limestone, about 8 inches in diameter is located about half way around the right side of the reservoir. A smaller opening is located approximately at the right abutment, contact. At the time of the inspection it was below the pool level, but appears to be 4 to 6 inches in diameter.

3.1.7 Downstream Channel: The downstream channel is a natural streambed through terrain characterized as hilly to mountainous. The slopes are moderate and have a good grass cover. The channel runs from the small stilling basin at the downstream toe of the dam. There are several homes, a gas station, and the parking facilities for Natural Bridge Visitors Center within one mile downstream of the dam.

3.2 Evaluation: Overall, the dam appears to be in good condition. However, the inspection revealed certain preventive maintenance items which should be scheduled as part of an annual maintenance program. These are:

a. The tree on the upstream slope should be cut down and the root structure removed. The subsequent hole should be backfilled with compacted fill and seeded.

b. A good stand of grass should be established to cover the entire upstream slope.

c. A staffgage should be installed in the reservoir to extend above the top of the dam.

SECTION 4
OPERATIONAL PROCEDURES

4.1 Procedures: The present normal pool elevation is approximatley 1234.65 feet mean sea level. The reservoir was designed for recreation but now serves as limited flood control. Seepage at approximate elevation 1234.65 passes into the underlying cavernous limestone. During heavy rains the pool rises and flows will pass downstream when the reservoir reaches elevation 1252.3, which is the crest of the right emergency spillway. The left emergency spillway crest is at elevation 1255.0. The reservoir can be lowered by removing the plug on the outlet pipe and rotating the stand pipe to the horizontal position.

4.2 Maintenance: There is no formal maintenance program.

4.3 Warning System: At present time, there is no warning system or emergency operation plan for Turner Dam.

4.4 Evaluation: The dam does not require an elaborate operation and maintenance procedure. However, a regular formal maintenance procedure should be established with documentation to detect and correct problems as they occur. It is recommended that a formal emergency procedure be prepared and furnished to all operating personnel. This should include:

a. How to operate the dam during an emergency.

b. Who to notify, including public officials, in case evacuation from the downstream area is necessary.

SECTION 5
HYDRAULIC/HYDROLOGIC DATA

5.1 Design: None were available.

5.2 Hydrologic Information: None were available.

5.3 Flood Experience: The maximum known pool was an elevation below the right emergency spillway.

5.4 Flood Potential: The 100-year flood, 1/2 PMF, and PMF were developed and routed through the reservoir by use of the HEC-1DB computer program (Reference 1, Appendix IV) and appropriate unit hydrograph, precipitation and storage-outflow data. Clark's Tc and R coefficients for the local drainage area were estimated from basin characteristics. The rainfall applied to the developed unit hydrograph was obtained form the U. S. Weather Bureau Publications (References 3, Appendix IV).

5.5 Reservoir Regulations: Pertinent dam and reservoir data are shown in Table 1.1.

Water passes automatically into the underlying cavernous limestone at approximately elevation 1234.65. The design normal pool has only been reached during flooding. The pool returns to elevation 1234.65 after the floods recede.

The storage curve was developed based on areas obtained from a U. S. Geological Survey Quadrangle Map. Survey data taken during the inspection was correlated to the Natural Bridge, Virginia Quadrangle Map to help develop area storage data. Rating curves for the emergency spillways, non-overflow section were developed. In routing hydrographs through the reservoir, it was assumed that the initial pool level was at elevation 1234.65 and flow into the underlying cavernous limestone was neglected.

5.6 Overtopping Potential: The probable rise in the reservoir and other pertinent information on reservoir performance is shown in the following table:

TABLE 5.1 RESERVOIR PERFORMANCE

Item	Normal flow	100 1/ Year Flood	1/2 PMF	PMF 2/
Peak flow, c.f.s.				
Inflow	1	641	1648	3296
Outflow	1	0	140	2149
Maximum elevation ft. msl	1234.65	1241.49	1252.90	1256.04
Non-overflow section elevation 1258.0				
Depth of flows, ft		-		
Duration, hrs.		-	-	-
Velocity, fps. 3/		-	-	-
Tailwater elevation ft msl	4/	-	-	-

1/The 100-Year Flood has one chance in 100 of occurring in any given year.
2/The PMF is an estimate of flood discharges that may be expected from the most severe combination of critical meteorologic and hydrologic conditions that are reasonably possible in the region.
3/Critical Velocity
4/ No tailwater values since outlet is plugged.

5.7 Reservoir Emptying Potential: A 10-inch steel pipe that can be rotated from the vertical to the horizontal position can be used to dewater the reservoir. The low level outlet will permit a withdrawal of about 5.4 cfs with the reservoir at elevation 1234.65 and essentially dewater the reservoir in less than one day. The reservoir is about 5 feet deep, therefore, sudden drawdown is not of concern.

5.8 Evaluation: Based on the size (intermediate) and hazard classification (significant) the recommended Spillway Design Flood is the 1/2 PMF to the PMF. Because of the risk involved, the 1/2 PMF has been selected as the SDF. The spillways will pass the PMF without overtopping the crest of the dam; therefore, the SDF can be passed.

Conclusions pertain to present day conditions and the effect of future development on the hydrology has not been considered.

SECTION 6

DAM STABILITY

6.1 Foundation and Abutment: There is no detailed information available on the foundation conditions. The dam is located within the Applachian Valley and Ridge physiographic province. This area is characterized by alternating northeastward trending ridges and intervening valleys. Rock in the vicinity of the dam is part of the Chepultepec Formation of Ordovician Age and consists of limestones and dolomites. A major geological structure in the area is the Pulaski-Staunton Fault. This thrust fault is probably partially responsible for much of the complex geology located in the area. The fault is believed to have caused Cambrian Age Formations to override and cover Ordovician and Devonian age strata. The dam site is apparently underlain by cavernous limestone. According to Mr. Barger, the foundation is keyed into the red, high plastic, residual clay. There is no known drainage system..

6.2 Embankment:

6.2.1 Material: There is no detailed information available on the embankment materials. The only known information is that the borrow area was located adjacent to the left side of the reservoir. The area soils are generally a residual, red, high plastic clay. The nature of the embankment materials is considered to be homogeneous.

6.2.2 Stability: There are no available stability calculations. The dam is 45.2 feet high and 22 feet wide at the crest. The upstream slope is 2.6 H: 1V, and the downstream slope is 3H:1V. The dam was designed for a normal pool elevation of about 1248 feet msl. The maximum storage pool elevation is approximately 1252.3 feet msl, the elevation of the emergency spillway's lowest point. Since the reservoir is about 5 feet deep, sudden drawdown is not a concern. The existing pool is approximately 17.65 feet below maximum storage pool due to the seepage into the underlying cavernous limestone. The dam has never been subjected to a maximum storage pool.

According to the guidelines presented in Design of Small Dams, U.S. Department of The Interior, Bureau of Reclamation , the slopes recommended for a small homogeneous earthfill dam on a stable foundation not subjected to a rapid drawdown are 3.5H:1V upstream and 2.5H:1V downstream. The recommended crest width is 19 feet.

Based on these guidelines, the dam has an inadequate upstream slope, and an adequate downstream slope. Its crest width of 22 feet is adequate.

6.2.3 Seismic Stability: The site is located in Seismic zone 2. Therefore, according to the Recommended Guidelines For Saftey Inspection Of Dams. The dam is considered to have no hazard from earthquakes provided that static stability conditions are satisfactory and conventional safety margins exists.

6.3 Evaluation: There is insufficient information to adequately evaluate the stability of the dam. However, the visual inspection revealed no apparent instability. Based on the Bureau of Reclamation Guidelines, the upstream slope is inadequate, but the downstream slope and crest width are adequate. The embankments are considered stable during both normal pool and maximum storage pool operations. In addition, overtopping is not a problem because the spillways will pass the spillway design flood selected for this dam without overtopping it. Also, based on the visual inspection, the foundation is considered sound. Therefore, no stability calculations are required.

SECTION 7

ASSESSMENT/REMEDIAL MEASURES

7.1 Dam Assessment: There is insufficient engineering data. However, the visual inspection did not reveal any findings that would prove the dam unsound. Overall, the dam is in good condition, and no immediate remedial measures are required. A stability check is not required.

The Corps of Engineers Guidelines indicate the appropriate spillway design flood (SDF) for the dam is 1/2 PMF since the dam is classified as being intermediate size with significant hazard. The dam will pass the 1/2 PMF without overtopping. Based on the visual inspection, the foundation is considered sound.

Based on a Bureau of Reclamation Guidelines, the upstream slope is inadequate, but the downstream slope and crest width are adequate.

There is no regular maintenance program nor is there an emergency warning plan.

7.2 Recommend Remedial Measures: It is recommended that the regular maintenance operation program be documented for future reference. A formal emergency procedure and warning system should be developed and put into operation as soon as possible. This should include how to operate the dam during an emergency; and who to notify, including public officals, in case evacuation from the downstream area is necessary. The local emergency services Coordinator of the State Office of Emergency and Energy Service can assist in the preparation of an emergency warning plan.

Also, the inspection revealed the following maintenance items that should be scheduled during a regular maintenance period within the next 12 months:

a. Check the embankments for animal burrows during periodic maintenance inspections and if found, fill with compacted soil and seed.

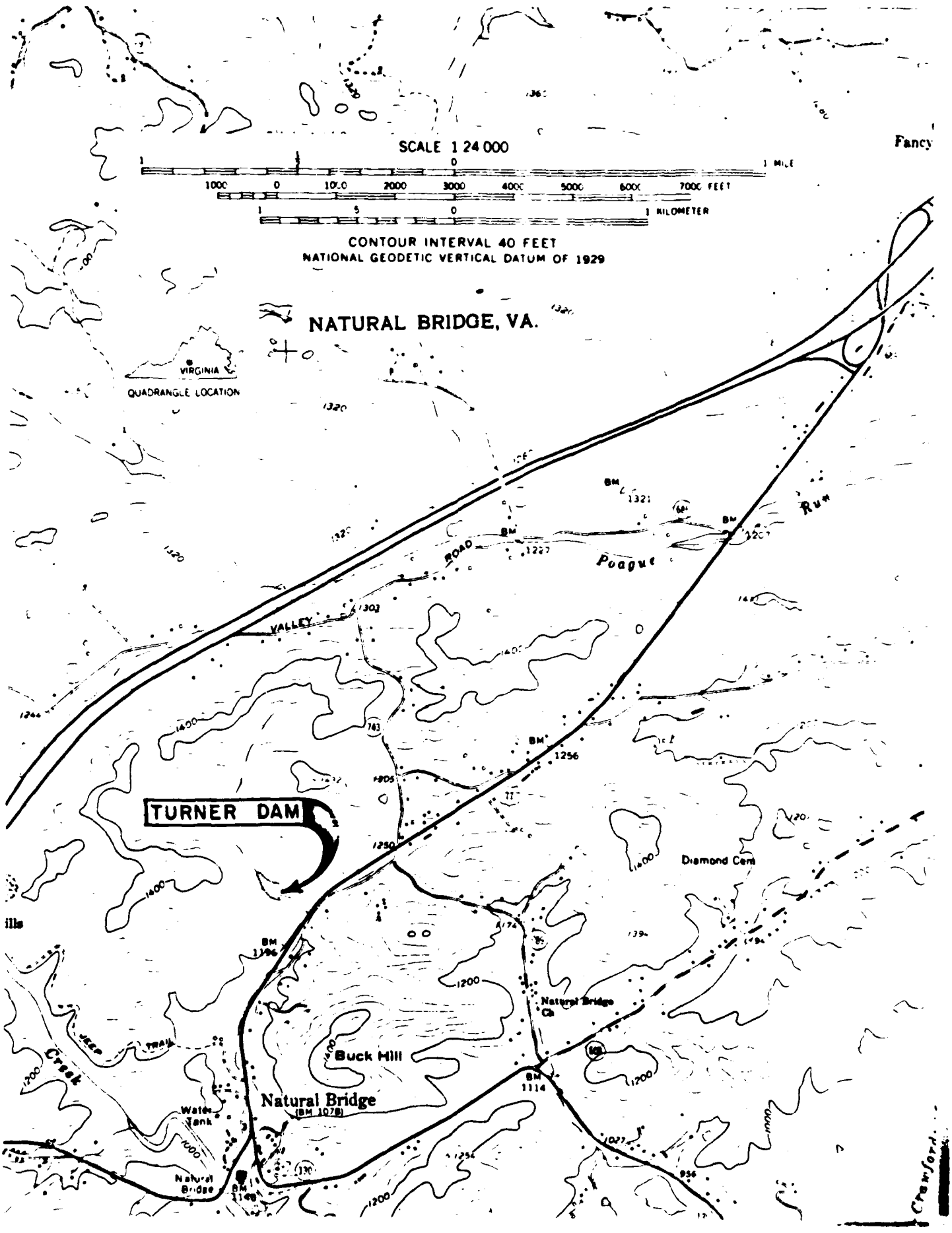
b. Cut the tree on the upstream and remove the root structure. Remove any trees and brush found during subsequent maintenance inspections. Fill all subsequent holes with compacted material and then sod or seed.

c. The bare portions of the upstream slope shall be seeded.

d. Install a staffgage in the reservoir to extend above the crest of the dam.

APPENDIX I

MAPS AND DRAWINGS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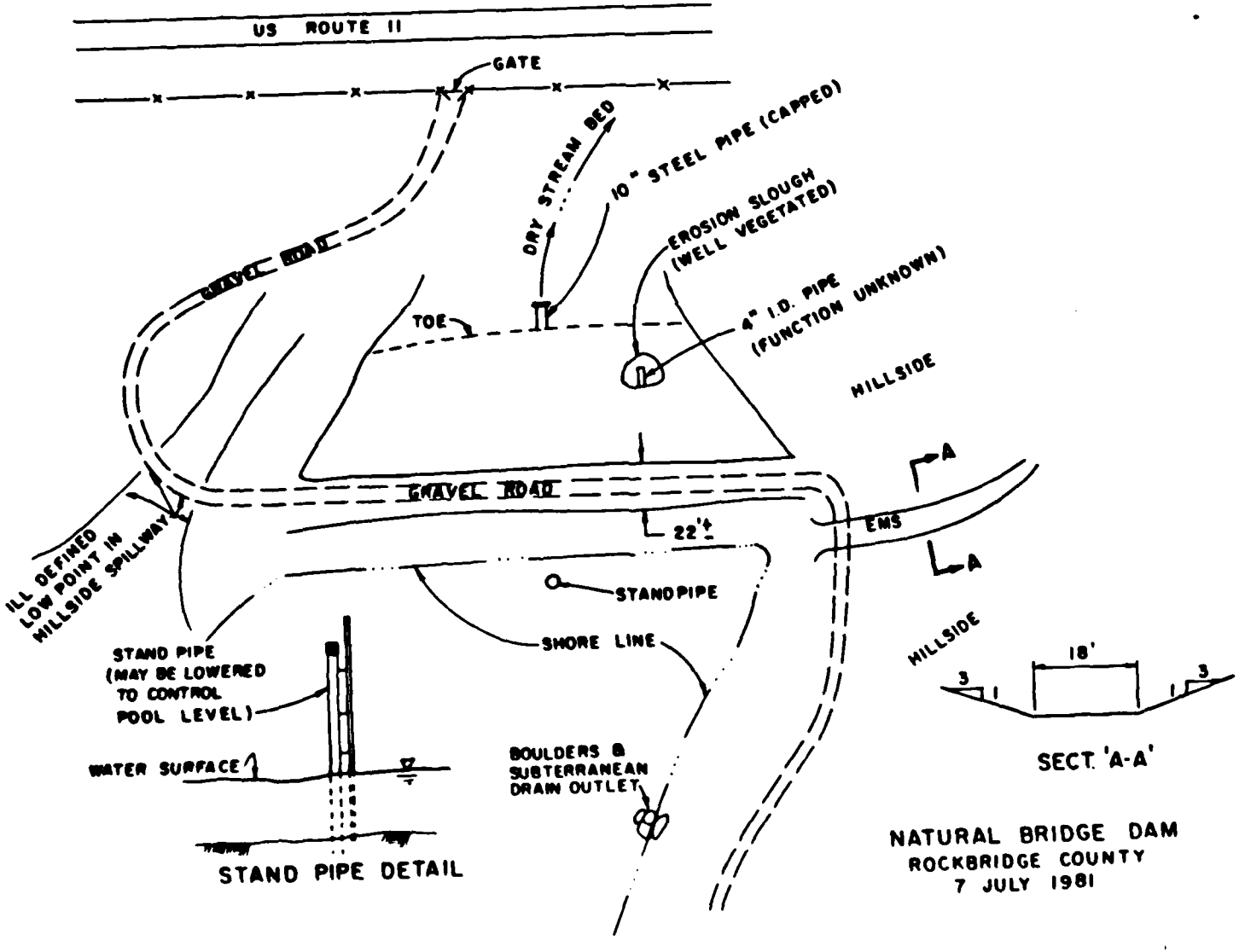
CONTOUR INTERVAL 40 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929
NATURAL BRIDGE, VA.
VIRGINIA
QUADRANGLE LOCATION
TURNER DAM
Natural Bridge
(BM 1078)
Buck Hill
Diamond Cem
Natural Bridge Ch
Water Tank
Natural Bridge
Creek
Jeep trail
ROAD
VALLEY
Fancy
Crawford


US ROUTE 11
GATE
DRY STREAM BED
10" STEEL PIPE (CAPPED)
EROSION SLOUGH (WELL VEGETATED)
4" I.D. PIPE (FUNCTION UNKNOWN)
TOE
HILLSIDE
GRAVEL ROAD
22'±
ILL DEFINED LOW POINT IN HILLSIDE SPILLWAY
EMS
A
A
STANDPIPE
SHORE LINE
STAND PIPE (MAY BE LOWERED TO CONTROL POOL LEVEL)
WATER SURFACE
BOULDERS & SUBTERRANEAN DRAIN OUTLET
HILLSIDE
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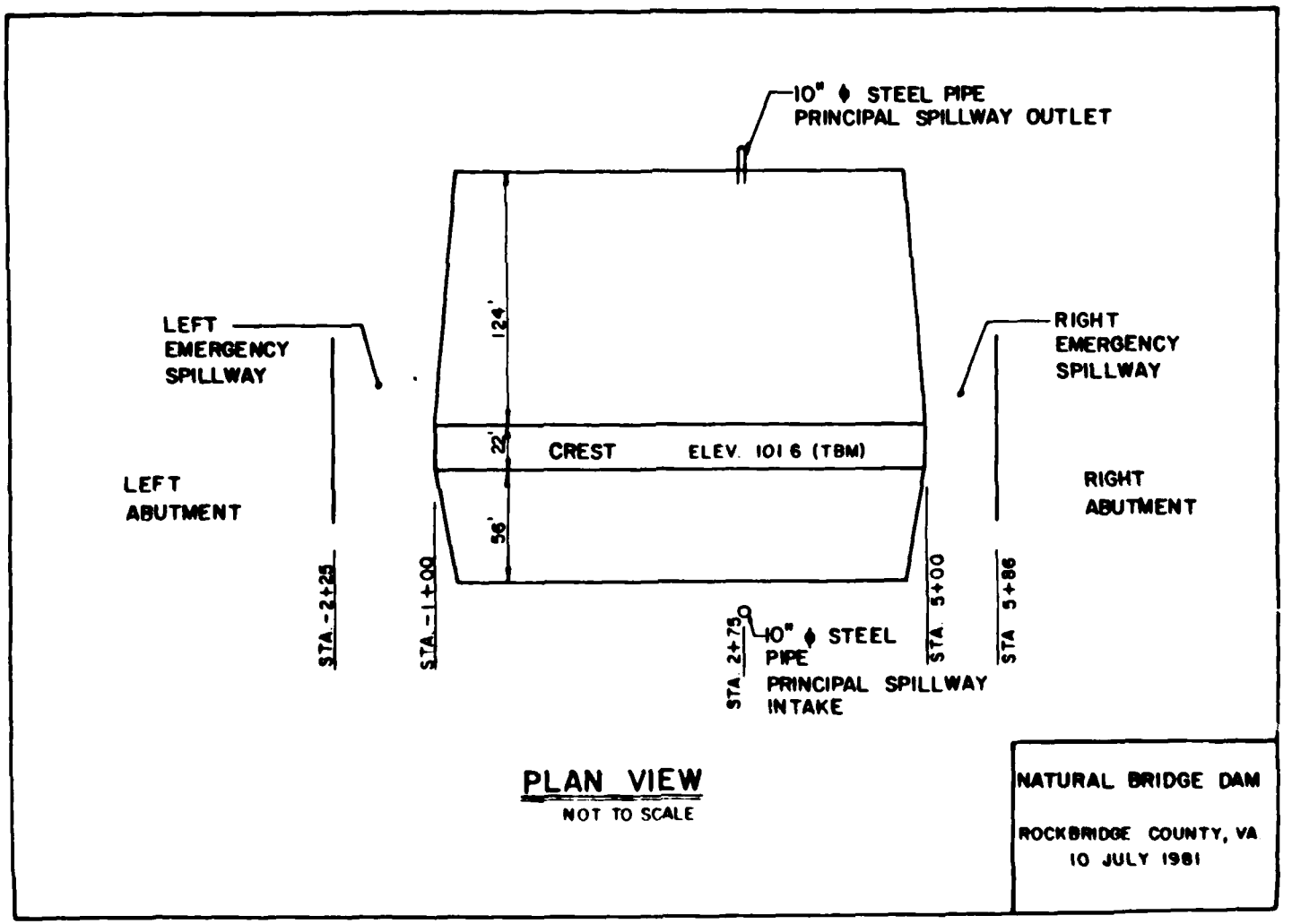
STAND PIPE DETAIL
NATURAL BRIDGE DAM
ROCKBRIDGE COUNTY
7 JULY 1981



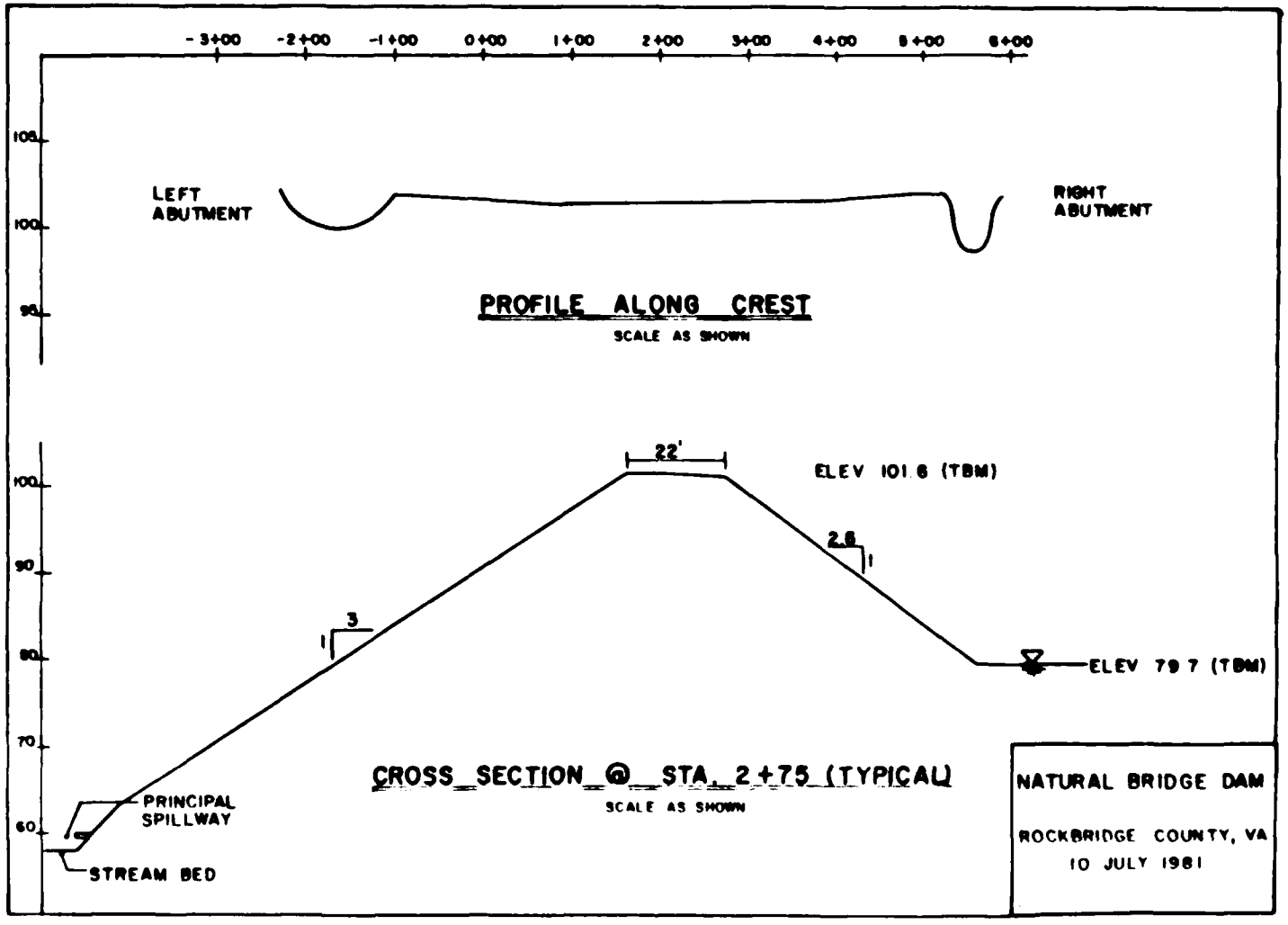
PLAN VIEW

NOT TO SCALE

NATURAL BRIDGE DAM

ROCKBRIDGE COUNTY, VA

10 JULY 1981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-2+00
-1+00
0+00
1+00
2+00
3+00
4+00
5+00
6+00
105
100
95
LEFT ABUTMENT
RIGHT ABUTMENT
PROFILE ALONG CREST
SCALE AS SHOWN
100
90
80
70
60
22'
ELEV 101.6 (TBM)
2.6
1
3
1
ELEV 79.7 (TBM)
PRINCIPAL SPILLWAY
STREAM BED
CROSS SECTION @ STA. 2+75 (TYPICAL)
SCALE AS SHOWN
NATURAL BRIDGE DAM
ROCKBRIDGE COUNTY, VA
10 JULY 1981

APPENDIX II

PHOTOGRAPHS

PHOTO #1 CREST OF DAM

PHOTO #2 DOWNSTREAM FACE

PHOTO #3 UPSTREAM FACE

PHOTO #4 PRINCIPAL SPILLWAY INTAKE STRUCTURE AND STAND PIPE

PHOTO #5 EMERGENCY SPILLWAY AT RIGHT ABUTMENT

PHOTO #6 EMERGENCY SPILLWAY AT RIGHT ABUTMENT

PHOTO #7 LOW AREA IN LEFT ABUTMENT (WOULD FUNCTION AS AUXILIARY EMERGENCY SPILLWAY)

PHOTO #8 DOWNSTREAM AREA (AS SEEN FROM CREST OF DAM)

APPENDIX III

FIELD OBSERVATIONS

Check List
Visual Inspection
Phase I

Name Dam: Turner Dam County: Rockbridge State: Virginia Coordinates: Lat. 37-38.5
Long. 79-32.5

Date of Inspection: 7 July 1981 Weather: Sunny Temperature: 90°F

Pool Elevation at Time of Inspection: 1234.65 ft msl Tailwater at Time of Inspection: 1212.8 ft msl 1/

Inspection Personnel:

Joe Miller, COE	Hugh Gildea, SWCB
Bo Taran, COE	Jesse Barger, local resident
Len Jones, COE	Winston B. Tolley, Manager of Natural Bridge
Jim Robinson*	Herman Furrow, Engineer for Natural Bridge

* Visited site on 24 June 1981.

Jim Robinson, Joe Miller Recorders

1/ This is actually the elevation of downstream channel at toe of dam. (Tailwater elevation could not be measured since downstream channel was dry and outfull pipe was capped).

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS	No surface cracks were visible. The general soil conditions were moist.	None.
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	There is no unusual movements or cracking at or beyond the toe.	None.
SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES	There is surface erosion of the upstream slope probably due to pedestrian and cattle traffic, and aggravated by surface runoff.	The bare areas should be seeded.
VERTICAL AND HORIZONTAL ALIGNMENT OF THE CREST	There are no drawings to compare the alignment. However, the alignments showed no signs of movement. The top of the dam serves as a gravel access road.	None.
RIPRAP FAILURES	There is no riprap.	None.

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
FOUNDATION	The foundation appears stable with no noticeable defects.	None.
ANY NOTICEABLE SEEPAGE	The pool is maintained at the present pool level by seepage into the underlying cavernous limestone.	None.
DRAINS	There are no known drains.	None.
MATERIALS	The embankment material is a red, high plastic clay borrowed from an area adjacent to the left side of the reservoir.	
VEGETATION	The downstream slope is entirety covered with a good stand of grass. The upstream slope is covered from the top halfway down the slope. The remaining portion of the upstream slope is the exposed embankment material. There is one tree about 12 inches in diameter on the upstream slope.	The bare portion of the upstream slope should be seeded. The tree should be cut down and the root structure removed. The subsequent hole should be backfilled with compacted fill and seeded.

PRINCIPAL SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONTROL SECTIONS	There is a 10-inch steel pipe acting as a drop-inlet stand pipe. The stand pipe extends about 12 feet above the water surface.	None
APPROACH CHANNEL	The approach channel is the reservoir.	None.
DISCHARGE CHANNEL	The outlet pipe is a 10-inch pipe that outlets near the toe of the dam. A plug was placed on the end of the outlet to prevent any flows due to leakage.	None.
EMERGENCY GATE	The principal spillway stand pipe can be rotated from a vertical to horizontal position and the plug removed from the outlet pipe to dewater the reservoir.	None.

LEFT EMERGENCY SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONTROL SECTIONS	The control section is located in natural ground with a good grass cover. A gravel road traverses the control section for access above the reservoir.	None.
APPROACH CHANNEL	The approach channel is grass covered and in good condition.	None.
DISCHARGE CHANNEL	The discharge channel is grass covered and in good condition.	None.
	RIGHT EMERGENCY SPILLWAY	
CONTROL SECTIONS	The control section was cut into natural ground with a good grass cover. A gravel road traverses the control section.	None.
APPROACH CHANNEL	The approach channel is grass covered and in good condition.	None
DISCHARGE CHANNEL	The discharge channel is grass covered and in good condition.	None.

INSTRUMENTATION

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
MONUMENTATION/SURVEYS	There are no known monuments in the immediate area.	None.
OBSERVATION WELLS	There are no wells	None.
WEIRS	There are no weirs	None.
PIEZOMETERS	There are no piezometers.	None.
STAFFGAGES	There are no staffgages	A staffgage should be installed in the reservoir to extend above the crest of the dam.

RESERVOIR

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SLOPES	The right reservoir slope is moderate and the left slope is gentle. Grass banks are located around the immediate reservoir and the rest of the drainage area is heavily wooded. There was no debris in the reservoir area. There are no signs of slope failures.	None.
SEDIMENTATION	The inspection team was unable to determine the sedimantation below the water surface at the time of the inspection. The area immediately above the reservoir shows no sedimentation problems.	None.

DOWNSTREAM CHANNEL

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	The downstream channel is the natural streambed that runs from the small stilling basin. There is no riprap protection around the stilling basin.	None.
SLOPES	The slopes have a good grass cover and are moderately sloped.	None.
APPROXIMATE NO.	There are several homes along U.S. Route 11 with a gas station and parking facilities, for Natural Bridge Visiting Center, that could sustain some damage during a dam failure.	None.

APPENDIX IV

REFERENCES

APPENDIX IV

REFERENCES

1. Recommended Guidelines for Safety Inspection of Dams, Office of the Chief of Engineers, Department of the Army, Washington, D. C.

2. HEC-1DB Flood Hydrograph Package, (Hydrologic Engineering Center, U. S. Army Corps of Engineers, September 1978.)

3. "Probable Maximum Precipitation Estimates, United States East of the 105th Meridian," Hydrometeorological Report No. 51, (U. S. Weather Bureau, June 1978).

4. "Rainfall Frequency Atlas of the Unites States", Technical Paper No. 40, (U.S. Weather Bureau, May 1961).

END

DATE
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